Nano Power Hall-Effect Switch IC

General Description

The ET3718A35SCE is produced with CMOS technology, which internally includes high sensitivity horizontal hall plates, sleep/awake logics for mode control, a low-power on-chip oscillator, low noise analog signal chain with dynamic offset cancellation, hysteresis comparators and an output driver.

The product responds to South pole magnetic fields. When the magnetic flux density (B) is larger than the operating point (B_{OPS}), the output will be turned on (Low). And the output will be turned off (High) when the magnetic flux density (B) is lower than the releasing point (B_{RPS}).

The ET3718A35SCE uses a small DFN4 with thermal pad package, and comply with RoHS standards.
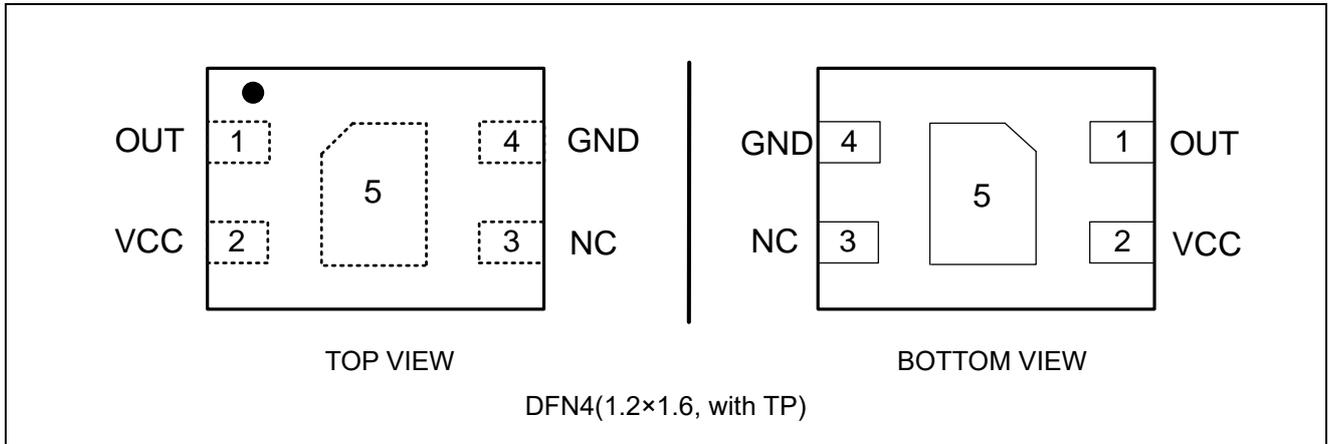
Features

- CMOS Technology
- Pole detection: S pole
- 1.65~5.5V Operating V_{CC} Range
- -40°C to +85°C Operating Temperature
- Package Option: DFN4(1.2×1.6) (with Thermal PAD)
- Magnetic Sensitivity Option: B_{OPS} = 3.5 mT typ.
- Output form: CMOS output
- Nano Power Consumption
- Average Supply Current = 500nA (V_{CC} = 1.8V)
- RoHS Compliant

Applications

- Home appliances, Industrial
- Position Detection
- Solid-State Switch
- Proximity Switch
- Smart Meter
- Handheld Device
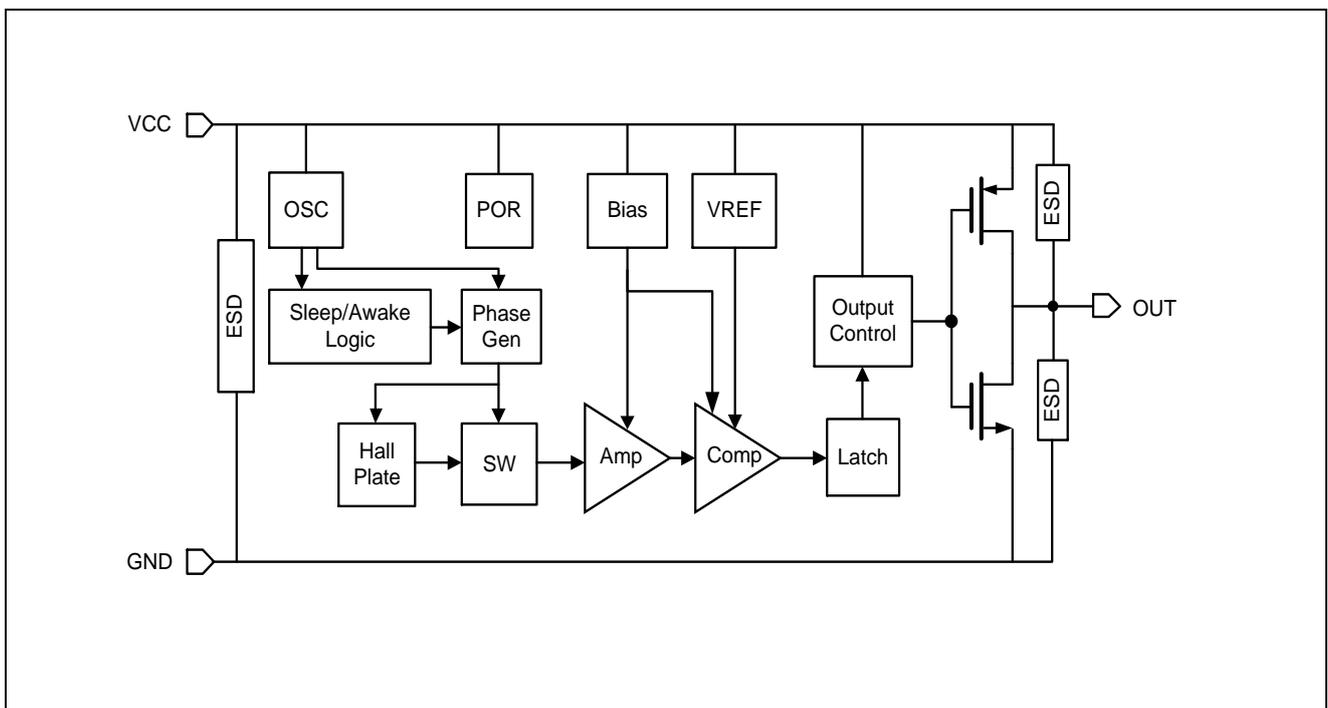
ET3718A35SCE

Pin Configuration

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      TOP VIEW                          BOTTOM VIEW
  ●
OUT  [1]        [4]  GND     GND  [4]        [1]  OUT
         5                              5
VCC  [2]        [3]  NC      NC   [3]        [2]  VCC
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                    DFN4(1.2×1.6, with TP)

Pin Function

Pin No.	Pin Name	Pin Function
1	OUT	Output pin
2	VCC	Power supply pin
3	NC	No connection
4	GND	Ground Pin
5	Thermal Pad*	No Connect

*: Thermal PAD Suggest floating or connecting to GND.

Block Diagram

Function Description

Applied magnetic flux

The magnetic flux applied to ET3718A35SCE should on the vertical direction on marking surface. If not, the horizontal component has no effect to detection. ET3718A35SCE is S pole type detector, the output voltage (V_{OUT}) is inverted when the S type magnetic flux is applied to IC.

Below shows the direction in which magnetic flux should be applied.

Figure 1. Magnetic flux direction
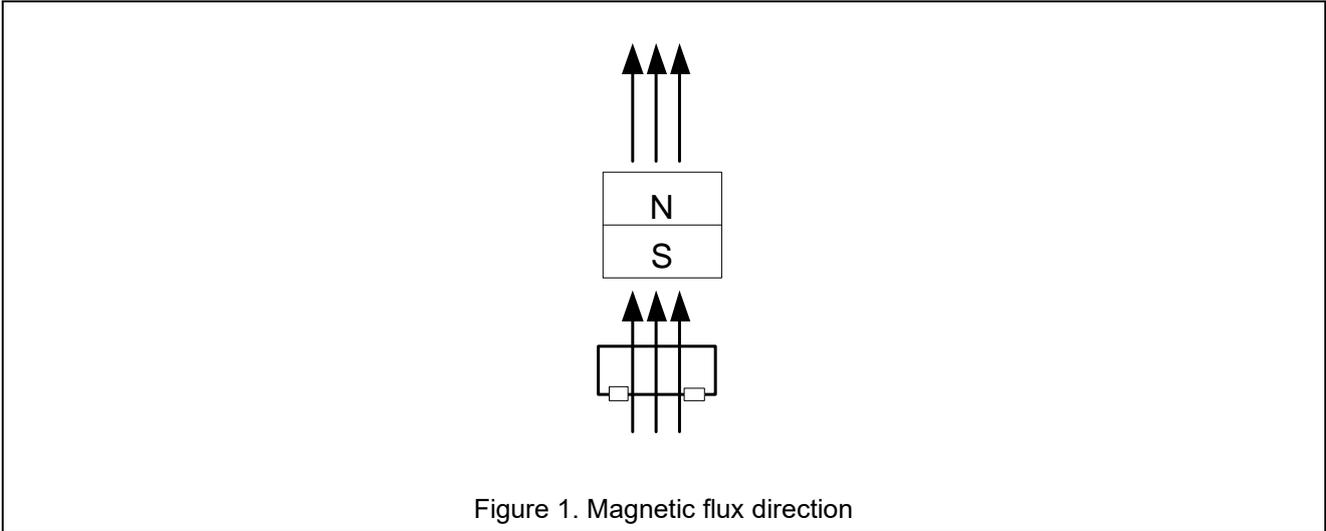
Detecting Operation

ET3718A35SCE detects magnetic field periodically. When vertical component of the magnetic flux applied to IC exceeds the operating point (B_{OPS}) such as the S pole of a magnet is moved closer to IC, V_{OUT} changes from "H" to "L". On the contrary, if magnetic flux is lower than the release point (B_{RPS}), V_{OUT} changes from "L" to "H".

The relationship between the magnetic flux density and V_{OUT} is shown below.

Figure 2. Magnetic flux density vs V_{OUT}
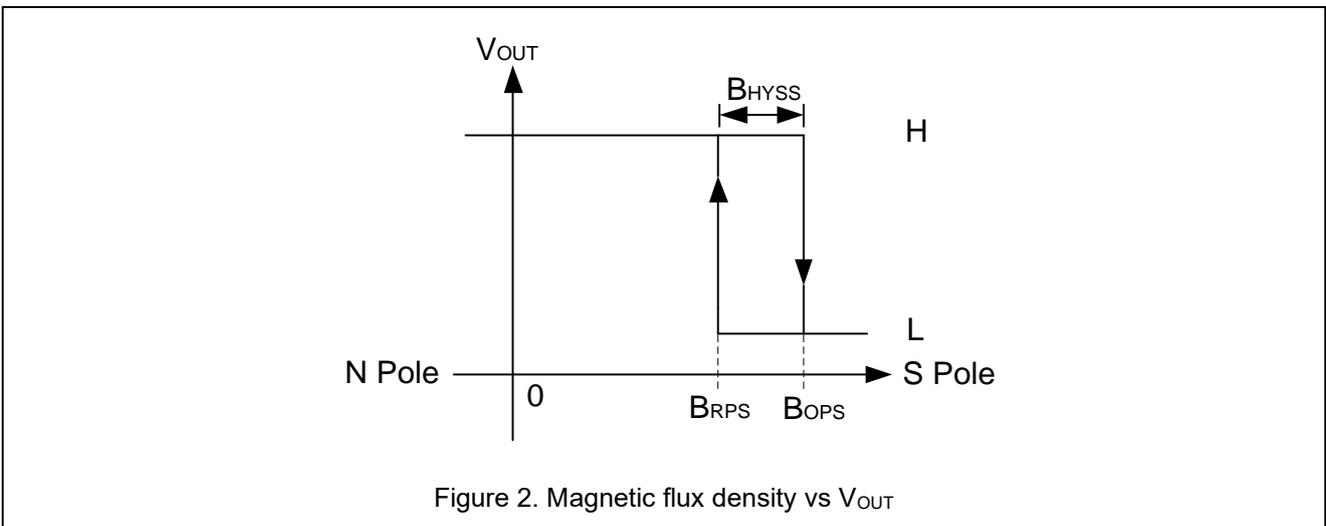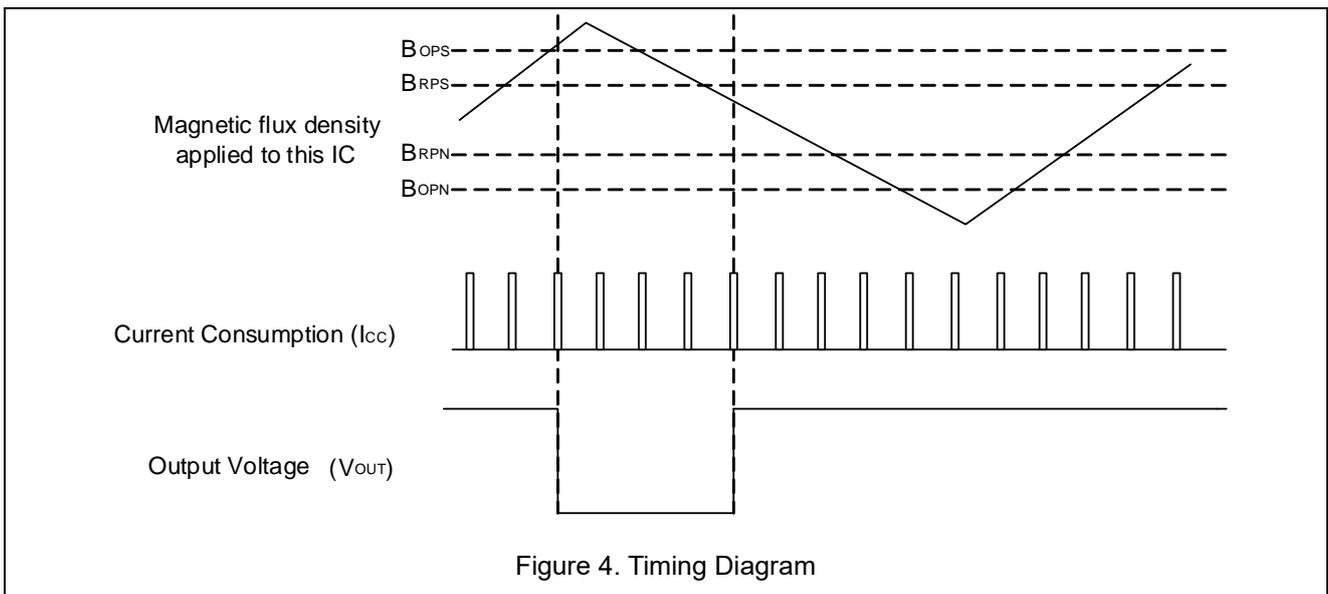
Operating Current

ET3718A35SCE performs the intermittent operation, therefore the average current consumption depends on the current in active mode , the active period (t_{AW}), the current in sleep mode, and sleep period(t_{SL}). The active current is about 1500 µA typically, and 0.6 µA at sleep mode. Please refer to electrical characteristic table for detail.

The time dependency of the current consumption is shown below.

Figure 3. Operating Current
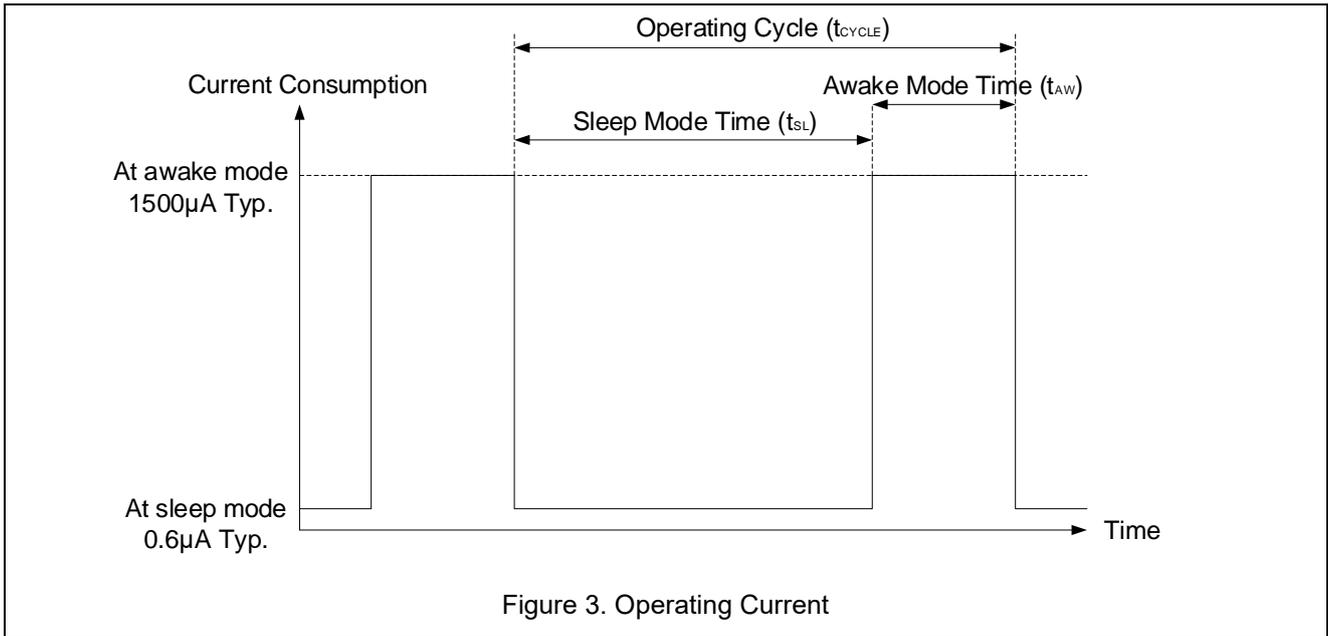
Timing Diagram

The operation timing of this IC is shown below.

Figure 4. Timing Diagram

Absolute Maximum Ratings

Symbol	Parameters	Rating	Units
V_{CC}	Supply Voltage	V_{GND}-0.3 ~ V_{GND} +7	V
V_{OUT}	Output Voltage	V_{GND} -0.3 ~ V_{GND} +7	V
I_{OUT}	Continuous Output Current	< 8	mA
T_A	Operating Ambient Temperature	-40 ~ 85	°C
T_S	Storage Temperature	-50 ~ 150	°C
T_J	Junction Temperature	<165	°C
θ_{JA}	DFN4(1.2×1.6,with TP)	220	°C/W
B	Magnetic Flux Density	No Limit	mT

Caution: The absolute maximum ratings are rated values exceeding which the product could suffer physical damage. These values must therefore not be exceeded under any conditions.

Electrical Characteristics

(T_A=+25°C, V_{CC}=3.6V, unless otherwise specified)

Symbol	Parameters	Test Condition	Min	Typ	Max	Unit
V_{CC}	Supply Voltage	Operating	1.65	3.6	5.5	V
I_{CC}	Average Supply Current	V_{CC}=3.6V	-	1.0	2.0	uA
		V_{CC}=1.8V	-	500	-	nA
I_{AW}	Awake Current	V_{CC}=3.6V	-	1.5	3.0	mA
I_{SL}	Sleep Current	V_{CC}=3.6V	-	0.6	1.8	uA
V_{OL}	Output Low Voltage	I_{OUT}=0.5mA, $|B|>|B_{OP}|$	-	-	0.2	V
V_{OH}	Output High Voltage	I_{OUT}=0.5mA, $|B|<|B_{RP}|$	V_{CC} -0.2	-	-	V
F_{SW}	Switching Frequency	V_{CC}=3.6V	10	20	40	Hz
T_{AW}	Awake Time		4	10	16	us
T_{SL}	Sleep Time		25	50	100	ms
D.C.	Duty Cycle		-	0.02	-	%
T_{PO}	Power on Time	dVcc/dt > 5V/us, $|B|>|B_{OP}|$	-	-	120	us

Magnetic Characteristics

(T_A = +25°C, V_{CC} = 1.65V~5.5V, unless otherwise specified)

Parameters		Symbol	Conditions	Min	Typ	Max	Unit
Operation point	S pole	B_{OPS}		1.5	3.5	5.5	mT
Release point	S pole	B_{RPS}		1.0	2.5	4.0	mT
Hysteresis width	S pole	B_{HYSS}	$B_{HYSS} = B_{OPS} - B_{RPS}$		1.0		mT

Notes:

(1) Operating points (B_{OPS}): B_{OPS} are the values of magnetic flux density triggers the output voltage (V_{OUT}) to low by increasing the S pole magnetic flux density applied to this IC. Even when the magnetic flux density is larger than B_{OPS}, V_{OUT} status is held.

(2) Release points (B_{RPS}): B_{RPS} are the values of magnetic flux density makes the output voltage (V_{OUT}) recover to high by decreasing the N pole or S pole magnetic flux density applied to this IC. Even when the magnetic flux density is lower than B_{RPS}, V_{OUT} status is held.

(3) Hysteresis widths (B_{HYSS}): B_{HYSS} are the difference between B_{OPS} and B_{RPS}, respectively.

(4) The unit of magnetic density mT can be converted by using the formula 1mT = 10Gauss.
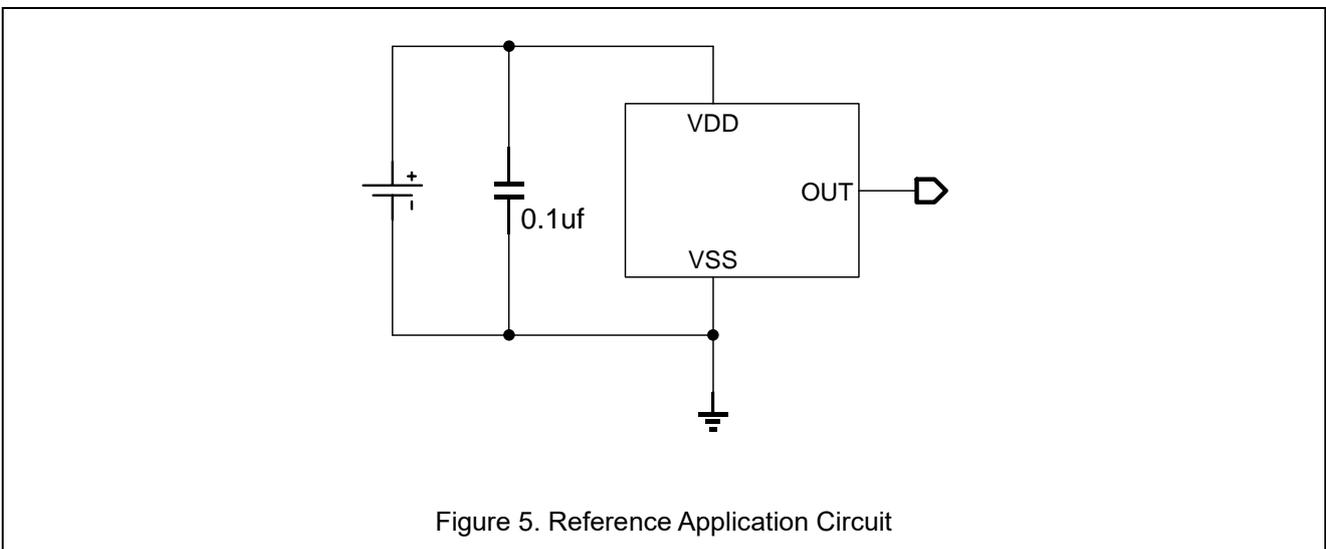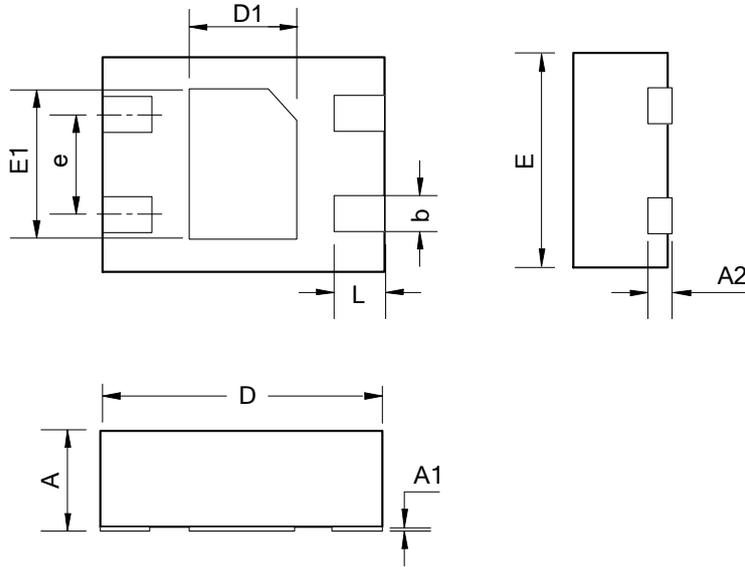
Application Circuit

Figure 5. Reference Application Circuit

Package Dimension

DFN4(with thermal pad)

COMMON DIMENSIONS (Unit: mm)

SYMBOL	MIN	NOM	MAX
A	0.40	-	0.50
A1	0	-	0.05
A2	0.125 REF		
b	0.15	0.20	0.25
D	1.55	1.60	1.65
D1	0.60	0.65	0.70
E	1.15	1.20	1.25
E1	0.80	0.85	0.90
e	0.65 BSC		
L	0.15	0.25	0.35

Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2024.10.10	Released Version	Zhangy	Wanggp	Zhujl